Department of the Environment
Industry Profile

Timber treatment works

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DOE Industry Profile

Timber treatment works

This profile is based on work by Dames and Moore International and was prepared for publication by the Building Research Establishment.

Timber treatment works

1. Background

This profile covers the formulation of timber preservative solutions and the treatment of timber with preservatives before use. This includes the formulation of preservatives used in remedial treatments, but not the application of remedial treatments. The profile does not deal with flame retardant treatments for timber.

The production of the active ingredients used in wood preservative formulations is covered by the profile on pesticides manufacturing works (see Section 4).

Modern industrial wood preservation in the United Kingdom started in about 1840 with the Bethell process. This applied creosote to sawn wood by a vacuum/pressure process using air-tight metal vessels; these were later developed into the treating cylinders still used today. Although many salt-based materials had also been used for wood preservation, it was not until the 1930s that the first copper-chromium-arsenic (CCA) water-borne solutions were introduced. These are also applied by vacuum/pressure processes and their use has steadily increased, particularly since the 1950s. The 1960s saw the growth of the organic solvent-based preservative industry when the need to treat exterior joinery was recognised. These were originally applied by simple immersion techniques but double vacuum processes are now usually used.

The sale, supply, storage, use or advertisement of all wood preservatives, insecticides and fungicides is now regulated by the Control of Pesticide Regulations 1986 (see Section 4). Under these Regulations, formulations for particular uses are approved in a process which takes account of the recommendations of the independent Advisory Committee on Pesticides (ACP), which are based on the data presented by the manufacturers on the efficacy and safety of their products. Specifications to assist in the manufacture of different wood preservative formulations are available in various British Standards, for example the specification for creosote is contained in BS 144: Part 1 and that for CCA in BS 4072: Part 1.

In the early years of the industry, most of the wood treated in the United Kingdom was imported, and therefore timber treatment works were often located near to ports and rivers. Timber treatment works which treated British-grown wood were sited near to the sources of supply, mainly Wales, Scotland, Lincolnshire and East Anglia. Historically, treatment facilities were often associated with sawmills and other timber works. For many years, timber merchants have had treatment facilities in their yards to enable them to supply their customers with treated timber.

As the road and rail infrastructure improved, and timber preservation became integrated into the fabrication process of timber products (for example window joinery), the number of treatment sites increased. Their distribution is now more general throughout the United Kingdom, often associated with timber products manufacturing works.

Consultation with industry has indicated that the greatest number of timber treatment plants existed in the early 1980s, when between approximately 900 and

1000 plants were in operation in the United Kingdom. The number declined during the late 1980s owing to the recession in the construction industry and the industry estimates that there are now about 800 timber treatment sites.

2. Activities

Wood preservation involves the formulation and impregnation of wood with chemicals toxic to wood-destroying organisms. Operations on some sites may include both the formulation of the preservative and the treatment of the timber, while other sites may carry out only formulation or treatment.

2.1 Formulation

The active ingredients and other materials required for the formulation and preparation of timber treating solutions are received from chemical works in liquid or solid state. The formulation of most wood preservative chemicals is typically undertaken by mixing the raw materials in a mixing vessel, often to form a concentrate. The resulting product is transferred to bulk storage or drumming plant areas prior to timber treatment on or off site.

2.2 Transfer of formulations

The prepared formulations used for timber treatment are typically transported as liquids or pastes.

Liquid formulations for use on site are generally piped to storage areas and from there to process areas. Pastes are stored in individual kegs or drums and transferred from storage areas to dilution units by fork-lift trucks, although small kegs may have been handled manually in the past.

Modern plants use containment bunds in the loading operation area, especially on larger sites; historically less rigorous controls may have applied. Once bulk liquids are in the storage tanks there is no manual handling except during maintenance or if unforeseen problems arise.

Formulated products for treatment off site are generally transported by bulk road or rail tanker in kegs or drums. Creosote is typically transferred as a liquid in bulk road/rail tankers. Aqueous CCA preservatives can be delivered as a dispersed solution or as a paste for dilution on site.

2.3 Treatment types

The three main types of treatment solution are:

creosote and creosote solutions
water-based copper-chromium-arsenic (CCA) solutions
light organic solvent solutions.

2.3.1 Creosote and creosote solutions

These include coal tar creosote and creosote dissolved in, or thinned, with organic solvents. Creosote is derived from industrial grades of coal tar which are distilled to produce various temperature fractions. The required fractions are then blended to specifications defined in British Standards. Creosote is used for external applications such as transmission poles, railway sleepers, gates, fencing and cladding. In the past, oils have occasionally been added to reduce the viscosity of creosote solutions. Industrial treatment plants, where high pressure/vacuum treatments are applied, now use only neat coal tar for creosote. Diluted forms are used in the production of garden fencing and for do-it-yourself applications. Its strong, persistent odour makes it unsuitable for use in buildings.

2.3.2 Water-based copper-chromium-arsenic solutions (CCA)

As their name suggests, these contain combinations of copper, chromium and arsenic compounds, either as salts or oxides. Application of CCA preservatives is by industrial high pressure/vacuum systems. The CCA becomes chemically fixed within the wood during a holding period after treatment, with the result that it is more resistant to leaching. Timber preserved in this way can be used for the same commodities as creosote-treated timber, although its lack of smell allows it to be used inside buildings (eg in roof trusses, joists, battens). CCA solutions are typically yellow/brown in colour.

2.3.3 Light organic solvent solutions

These are composed of active ingredients such as lindane, organo-tin, pyrethroids, metal carboxylates, pentachlorophenol and (historically) dieldrin, dissolved in a light organic solvent such as white spirit, kerosene or other petroleum distillates. The solutions may also contain organic resins or waxes as binding agents, anti-bloom agents and water repellents. They are commonly used for building timbers. Unlike water-based preservatives, they do not create dimensional changes in treated wood, which might cause problems with machined components such as joinery, and are therefore particularly useful for these products. The solutions are usually almost colourless to avoid over-painting problems. However, additives such as pigments and dyes (brown, yellow and green are common) may be mixed with the preservative solution to give visual aids to the degree of treatment achieved.

2.4 Treatment processes

The main industrial methods of applying wood preservatives utilise pressure and/or vacuum techniques, or immersion; the latter is decreasing in use.

2.4.1 Pressure/vacuum treatments

High pressure/vacuum processes are used to apply creosote and CCA formulations. In the full cell process, the wood is placed on bogies and pushed or pulled into the plant chamber. The sealed chamber is subjected to an initial vacuum, then flooded with preservative and subjected to hydraulic pressure for a set period of time, or until the desired amount of preservative has been forced into the wood. The pressure is then released, the preservative is pumped out and a final vacuum applied to help dry the wood. The empty cell process omits the initial vacuum or replaces it with a pressure period to increase the air pressure in the wood. This allows a greater proportion of the preservative to be recovered from the timber at the end of treatment.

The double vacuum process is associated with the application of organic solvent solutions and uses low pressure/vacuum schedules. An initial vacuum is applied and held for a period, then the chamber is flooded with preservative. The vacuum is released until atmospheric pressure is reached forcing the preservative into the wood. Sometimes an over-pressure of 1-2 bar is applied. A final vacuum is applied to recover some of the liquid absorbed and to provide a clean, dry surface.

Pressure/vacuum treatments are usually carried out at ambient temperatures, apart from creosote treatments where the operations are at an elevated temperature.

Treated wood may be dried in the air or in low temperature kilns. Modern treatment plants and storage areas for newly-treated timber are bunded and provided with a roof to avoid rainwater washing preservative from the surface of the timber. Older plants will have been open to the weather and will not have had bunding systems to contain drippings or rainwater run-off. Some of the plants have been known to be situated below ground level with or without bunding.

The location of pressure treatment plants is likely to have remained fixed within a timber yard or sawmill, except where, perhaps, sites were expanded.

2.4.2 Immersion treatment

Simple immersion of exterior joinery in organic solvent type preservatives is still recommended in British Standard Codes as a means of treatment, although its use is decreasing in favour of the more effective double vacuum treatments.

Freshly-felled timber is sometimes treated to prevent the growth of disfiguring sapstain fungi. In sawmills which utilise British-grown softwood timber, there may be large tanks in which planks of timber are immersed in water-based solutions of fungicide for a few seconds. After treatment, the timber is stacked to dry. At this stage, excess preservative may drip onto the standing area, which nowadays may be concreted to contain run-off, although this may not have been the case in the past. Similarly, wooden products manufactured from undried timber, for example interwoven fence panels, known as 'larch lap', are dipped in anti-mould formulations to protect against staining prior to delivery.

In the past, the most common anti-sapstain chemical used was sodium pentachlorophenoxide in aqueous solution. Although this is still used, alternative chemicals are currently being tested as replacements.

2.5 Treated products

Treated timber in sawn form is used either directly in construction or to prepare construction components, such as trussed rafters or timber frame panels. Planed joinery components and most fencing products are treated either after assembly or in 'knock-down' form after completion of all machining.

After treatment, timber is transferred to a storage area, often using fork-lift trucks. Larger sites may have specific areas for storage but smaller sites may have no fixed pattern. Concreted storage areas were generally introduced by companies in the late 1970s to early 1980s as part of standard plant design; previously less rigorous ground protection measures were prevalent and on some sites this may continue to be the case.

2.6 Wastes

Wastes generated include sludges from the base of storage tanks and contaminated sawdust, produced for example by mopping up spills and leaks.

Waste handling involved both mechanical and manual drum handling methods. If solutions are recycled, they may require filtering. A filter cake waste is produced which is stored until sufficient quantity has been collected to send for off-site disposal. A further major source of waste is contaminated rainwater, for example accumulated in bunds.

2.7 Ancillary activities

Non-production activities may include on-site electricity generation. Some pre-treatment facilities may have a low temperature kiln or a steam generating boiler. Large creosote plants may have a wastewater treatment facility.

3. Contamination

The contaminants on a site will largely depend on the history of the site and on the range of materials produced there. Potential contaminants are listed in the Annex and the probable locations on site of the main groups of contaminants are shown in Table 1. It is most unlikely that any one site will contain all of the contaminants listed. It is recommended that an appropriate site investigation be carried out to determine the exact nature of the contamination associated with individual sites.

3.1 Factors affecting contamination

Sites may have been occupied by the industry over a considerable period, during which time the nature of the activities and the physical location of plant buildings and storage areas may have changed. The particular areas where ground contamination may have occurred are:

preservation delivery, storage, blending and transfer areas
treatment areas
storage areas for treated wood
underground storage tanks and pipelines
soil soakaways or drainage systems
waste storage and disposal areas.

While the management of a modern plant would be expected to be adequate to prevent significant contamination for example through efficient bunding, ground protection, covered storage areas and the like, older works are unlikely to have had such robust controls to prevent ground contamination.

Since the industry makes extensive use of liquid chemicals and many operations may have taken place in open areas, the effects of spills, leaks and rainwater on materials storage areas could be significant. Thus, soil or concrete areas used for drying treated wood, which are typically open and flat, together with any in-ground bunds, collection sumps and soakaways, could present the most significant potential for contamination, particularly where operations have taken place over many years. Also, plant situated below ground would be expected to present a greater risk of ground contamination.

In addition, it is likely that areas around underground storage tanks which contained quantities of fuel oil, petrol, diesel or wastes may have become contaminated through leakage of tanks and associated pipework.

Transformers or capacitors, in electricity substations, may have contained polychlorinated biphenyls (PCBs) in dielectric fluids. There may be potential for contamination around these areas.

Disposal of partly empty drums, treated products or sawdust used to mop up spills are examples of where waste disposal could result directly or indirectly in ground contamination. Timber-based wastes used as landfill could also give rise to the generation of landfill gas.

Fires in storage areas or other parts of the site may be a further potential cause of contamination, through spillages of preservatives, the dispersion of contaminants aerially and from the run-off of fire-fighting water.

Asbestos contamination may have arisen generally around the site following its removal from buildings or pipework, where it may have been used as cladding, roofing or insulation.

Areas of concrete hardstanding in process and drying areas may be contaminated with persistent organic chemicals. Consideration should be given to the possibility of contamination if such areas are to be broken out, crushed and reused during any reclamation work.

3.2 Migration and persistence of contaminants

3.2.1 Metals

Investigations of treatment plant sites using CCA preservatives have indicated that where the preservatives have contaminated the soil, the copper, chromium and arsenic compounds have tended to remain in the upper surface layers of the soil and extensive vertical migration of these elements has not taken place.

The solubility of some metals (for example copper and zinc) may increase under acidic conditions. In other cases the relationship is more complex. For example, trivalent chromium is more soluble under acidic conditions, whereas the solubility of hexavalent chromium is increased under both acidic and alkaline conditions and arsenic may become more soluble at higher pHs. The movement of metals through the soil is significantly retarded by the presence of clay minerals and organic matter.

3.2.2 Organic compounds

Many of the organic solvents liable to be encountered are volatile with moderate to high vapour pressures. They will readily partition from the liquid phase to the vapour phase resulting in high concentrations in the soil pore space above the unsaturated zone. Close to the soil surface, some will be lost directly to the atmosphere by evaporation. Some of the other less soluble solvents, for example toluene, may migrate to the water-table. In most cases, such compounds are less dense than water and will therefore float on the water-table surface. However, chlorinated solvents are denser than water and will tend to migrate to the bottom of water bodies. Their migration may not be consistent with the general groundwater flow.

Organic contaminants with an inherently high mobility include the phenols, particularly phenol itself, which is very soluble and can migrate considerable distances from its source. Phenols can also permeate water supply pipes made of polymeric materials such as polyvinyl chloride (PVC). The occurrence of widespread contamination by solvents may increase the mobility and potential for groundwater contamination by organic compounds which, though of low aqueous solubility, may dissolve readily in such organic solvents.

The transport and fate of organic compounds within soil will be dependent on a combination of physical, chemical and biological factors. The higher the organic matter and clay content within the soil, the greater the degree of adsorption of the organic compounds and the slower their migration. Thus, the greatest degree of migration will occur in coarse-grained sands and gravels with little organic matter. The less soluble compounds which become adsorbed to clay or organic matter will provide on-going sources of water pollution long after the source has been removed, by continuing to desorb into the soil-water. Therefore, the risk from buried organic compounds to current and potential water supplies may be considerable. Lateral movement through the soil, either in the dissolved or free phase, may also affect surface water.

Biodegradation processes in soils can be influenced by a number of factors, namely moisture content, oxygen concentration and pH, acting separately or in combination. For example low moisture content reduces microbiological activity, while high moisture content can reduce oxygen penetration and possibly lead to anaerobic soil conditions. Such conditions enhance the biodegradation of some materials, for example chlorinated compounds, while aerobic conditions are needed to biodegrade many oils. Also, low pHs tend to reduce the bacterial population and encourage fungal activity; at pHs lower than 5, microbiological activity is much reduced. The presence of heavy metals also inhibits micro-organisms. As a result of these factors, at high concentrations in soil, even relatively non-persistent compounds may not biodegrade readily. The organic compounds used as timber treatment chemicals are generally highly persistent.

Chlorinated solvents are persistent chemicals and can render groundwater unsuitable for public supply, even at low concentrations. Halogenated organic solvents are generally more persistent than the corresponding non-halogenated compounds.

3.2.3 Other factors

Certain plants can absorb pesticides and metallic compounds; herbicides and fungicides are designed to be taken up by plants but insecticides can also penetrate plant material.

PCBs and some of the halogenated organic compounds are fat soluble and have a propensity to accumulate in food chains.

Wind dispersion of contaminated soil may be a further transport mechanism where there is gross surface contamination by some of the less mobile contaminants, particularly metals and asbestos. Asbestos is neither soluble nor biodegradable and persists in the soil.

As indicated earlier, the occurrence of any fires on site may have greatly influenced the migration of potential contaminants.

4. Sources of further information

4.1 Organisations

For information concerning the wood preservative manufacture and timber treatment industries in the United Kingdom, the following organisations should be consulted:

The British Wood Preserving and Damp-proofing Association (BWPDA)
PO Box 894
London
E15 4EB

The Nationwide Association of Preserving Specialists
3 Cowper Road
London
SW19 1AA

4.2 Sources of information concerning the activities described in this profile

Austin G T. *Shreve's chemical process industries.* 5th Edition. McGraw-Hill, London, 1984.

British Standards Institution. *Code of practice for the identification of potentially contaminated land and its investigation.* Draft for Development DD175. BSI, London, 1988.

Building Research Establishment. *Wood preservatives: application methods.* Digest No. 201, 1977.

Dragun J. *The soil chemistry of hazardous materials.* Hazardous Materials Control Research Institute, Silver Springs, MD, USA, 1988.

Her Majesty's Inspectorate of Pollution et al. *Code of practice for the safe design and operation of timber treatment plants.* Drafted by Her Majesty's Inspectorate of Pollution, the National Rivers Authority, the Health and Safety Executive and the British Wood Preserving and Damp-proofing Association 1991.

Hill I R and Wright S J L (Editors). *Pesticide microbiology.* Academic Press, London, 1978.

Ministry of Agriculture, Fisheries and Food/ Health and Safety Executive. *Pesticides handbook (pesticides approved under The Control of Pesticides Regulations).* London, HMSO, published annually.

Rochkind-Dubinsky M L, Sayler G S and Blackburn J W. *Microbial decomposition of halogenated aromatic compounds.* Marcel Dekker Inc., New York, 1987.

Wallnfer P R and Engelhardt G. *Microbial degradation of pesticides.* In 'Chemistry of Plant Protection. Volume 2'. Editors G Haug and H Hoffman, Springer-Verlag KG, Berlin, 1989.

Wilkinson J G. *Industrial timber preservation.* Associated Business Press, London, 1979.

Case study including information relevant to this Industry Profile:

Paul V. *Bibliography of case studies on contaminated land: investigation, remediation and redevelopment.* Garston, Building Research Establishment, 1995.

Information on researching the history of sites may be found in:

Department of the Environment. *Documentary research on industrial sites.* DOE, 1994.

4.3 Related DOE Industry Profiles

Chemical works: pesticides manufacturing works
Timber products manufacturing works

4.4 Health, safety and environmental risks

The Notes issued by the Chief Inspector of Her Majesty's Inspectorate of Pollution (HMIP) provide guidance for the processes prescribed for integrated pollution control in Regulations made under the Environmental Protection Act 1990. Of particular relevance are:

Her Majesty's Inspectorate of Pollution. *Pesticide processes.* Chief Inspector's Guidance to Inspectors, Process Guidance Note IPR 4/8. London, HMSO, 1992.

Her Majesty's Inspectorate of Pollution. *Timber preservation processes.* Chief Inspector's Guidance to Inspectors, Process Guidance Note IPR 6/3. London, HMSO, 1995.

Department of the Environment. *Chemical treatment of timber and wood-based products.* Process Guidance Note PG 6/3. London, HMSO, 1991.

The Control of Substances Hazardous to Health (COSHH) Regulations 1994 and the Management of Health and Safety at Work Regulations 1992 are available from HMSO. Information on relevant health and safety legislation and approved codes of practice published by HSE publications are available from Health and Safety Executive Books, PO Box 1999, Sudbury, Suffolk, CO10 6FS (telephone 01787 881165), as well as HMSO and other retailers.

Information on the health, safety and environmental hazards associated with individual contaminants mentioned in this profile may be obtained from the following sources:

Howard P H. *Handbook of environmental fate and exposure data for organic chemicals.* Vols I and II. USA, Lewis Publishers, 1990.

Sax N and Lewis R. *Hazardous chemicals desk reference.* New York, Van Nostrand Reinhold Company, 1987.

Verschueren K. *Handbook of environmental data on organic chemicals.* 2nd Edition. New York, Van Nostrand Reinhold Company, 1983.

4.5 Waste disposal and remediation options

Useful information may be obtained from the Department of the Environment series of Waste Management Papers, which contain details of the nature of industrial waste arisings, their treatment and disposal. A current list of titles in this series is available from HMSO Publications Centre, PO Box 276, London, SW8 5DT. Of particular relevance is:

Department of the Environment. *Wood-preserving wastes.* DOE Waste Management Paper No.16. HMSO, London, 1980.

Publications containing information on the treatment options available for the remediation of contaminated land sites, prepared with the support of the Department of the Environment's Research Programme, can be obtained from National Environmental Technology Centre Library, F6, Culham, Abingdon, Oxfordshire, OX14 3DB.

A full list of current titles of Government publications on all aspects of contaminated land can be obtained from CLL Division, Room A323, Department of the Environment, Romney House, 43 Marsham Street, London, SW1P 3PY.

Advice on the assessment and remediation of contaminated land is contained in guidance published by the Construction Industry Research and Information Association (CIRIA), 6 Storey's Gate, Westminster, London, SW1P 3AU.

Annex Potential contaminants

The chemical compounds and other materials listed below generally reflect those associated with the industry and which have the potential to contaminate the ground. The list is not exhaustive; neither does it imply that all these chemicals might be present nor that they have caused contamination.

Principal chemicals

Organochlorines	gamma-hexachlorocyclohexane (lindane[1]) dieldrin (banned under the Control of Pesticides Regulations)
Phenolics[1]	pentachloraphenol sodium pentachlorophenoxide
Organotin compounds	tributyltin oxide tributyltin phosphate tributyltin naphthenate
Metal carboxylates	copper and zinc naphthenates acypetacs zinc (petroleum acids) zinc versatate (C_{10} petroleum acid)
Pyrethroids	permethrin cypermethrin
Creosote	a coal tar derivative which may contain phenols and polyaromatic hydrocarbons (PAHs)
Copper/chrome/arsenic preparations	eg copper sulphate/sodium dichromate/ arsenic pentoxide, or copper oxide/ chromium trioxide/arsenic pentoxide
Organic solvents	petroleum distillates eg kerosene white spirit halogenated solvents
Additives	organic resins and waxes anti-bloom agents water repellents pigments and dyes

[1] use as a wood preservative restricted to professional and industrial operators

Other potential contaminants

Tars	Polycyclic aromatic hydrocarbons (PAHs)
Polychlorinated biphenyls (PCBs)	
Asbestos	
Diesel, oil and other fuels	
Coal and associated ash	
Effluent treatment chemicals	eg hydrochloric acid sodium bisulphate (pH adjusters)

Table 1 Main groups of contaminants and their probable locations

Timber treatment works

Main groups of contaminants	Location										
	Raw materials delivery/storage/ transfer	Process buildings		Products storage/ transfer	Wastes storage	Waste disposal	Process pipework/ pumps	Drainage system including soakaways	Fuel storage/ pipework	Electricity transformer areas	Effluent treatment areas[2]
		Pressure/ vacuum	Immersion								
Copper-chromium-arsenic (CCA) solutions[1]	■	■		■	■	■	■	■			
Asbestos						■	■ 3				
Creosotes	■	■	■	■	■	■	■	■			■
Light organic solvent solutions[1]	■	■	■	■	■	■	■	■			■
Tars			■		■	■					■
Polychlorinated biphenyls (PCBs)										■	
Fuel oil/coal/ash	■				■	■		■	■		
Effluent treatment chemicals/sludges	■				■	■	■				■

[1] Including additives
[2] Larger plants only
[3] Steam mains

Shaded boxes indicate areas where contamination is most likely to occur

DOE Industry Profiles

Airports
Animal and animal products processing works
Asbestos manufacturing works
Ceramics, cement and asphalt manufacturing works
Chemical works: coatings (paints and printing inks) manufacturing works
Chemical works: cosmetics and toiletries manufacturing works
Chemical works: disinfectants manufacturing works
Chemical works: explosives, propellants and pyrotechnics manufacturing works
Chemical works: fertiliser manufacturing works
Chemical works: fine chemicals manufacturing works
Chemical works: inorganic chemicals manufacturing works
Chemical works: linoleum, vinyl and bitumen-based floor covering manufacturing works
Chemical works: mastics, sealants, adhesives and roofing felt manufacturing works
Chemical works: organic chemicals manufacturing works
Chemical works: pesticides manufacturing works
Chemical works: pharmaceuticals manufacturing works
Chemical works: rubber processing works (including works manufacturing tyres or other rubber products)
Chemical works: soap and detergent manufacturing works
Dockyards and dockland
Engineering works: aircraft manufacturing works
Engineering works: electrical and electronic equipment manufacturing works (including works manufacturing equipment containing PCBs)
Engineering works: mechanical engineering and ordnance works
Engineering works: railway engineering works
Engineering works: shipbuilding, repair and shipbreaking (including naval shipyards)
Engineering works: vehicle manufacturing works
Gas works, coke works and other coal carbonisation plants
Metal manufacturing, refining and finishing works: electroplating and other metal finishing works
Metal manufacturing, refining and finishing works: iron and steelworks
Metal manufacturing, refining and finishing works: lead works
Metal manufacturing, refining and finishing works: non-ferrous metal works (excluding lead works)
Metal manufacturing, refining and finishing works: precious metal recovery works
Oil refineries and bulk storage of crude oil and petroleum products
Power stations (excluding nuclear power stations)
Pulp and paper manufacturing works
Railway land
Road vehicle fuelling, service and repair: garages and filling stations
Road vehicle fuelling, service and repair: transport and haulage centres
Sewage works and sewage farms
Textile works and dye works
Timber products manufacturing works
Timber treatment works
Waste recycling, treatment and disposal sites: drum and tank cleaning and recycling plants
Waste recycling, treatment and disposal sites: hazardous waste treatment plants
Waste recycling, treatment and disposal sites: landfills and other waste treatment or waste disposal sites
Waste recycling, treatment and disposal sites: metal recycling sites
Waste recycling, treatment and disposal sites: solvent recovery works
Profile of miscellaneous industries incorporating:
- Charcoal works
- Dry-cleaners
- Fibreglass and fibreglass resins manufacturing works
- Glass manufacturing works
- Photographic processing industry
- Printing and bookbinding works

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